

SIGNIFICANT POINTS

- Persons with college training in advanced technology will have the best opportunities.
- Employment growth and opportunities vary among segments of the industry.
- Production workers' earnings are significantly higher than in most other industries.

Nature of the Industry

The simple act of walking into a restroom, turning on the light, and washing your hands, uses the products of perhaps four different utilities. Electricity powers the light, water supply systems provide water for washing and drinking, wastewater treatment plants treat the sewage, and natural gas or electricity heats the water. Some government establishments do the same work and employ a significant number of workers; however, information about them is not included in this statement. Information concerning government employment in public utilities is included in the *Career Guide* statements on Federal Government and State and local government, excluding education and hospitals. Each of the various segments within the public utilities sector is distinctly different.

Electric services. This segment includes firms engaged in the generation, transmission, and distribution of electricity for sale. Electric plants harness highly pressurized steam or some force of nature to spin the blades of a turbine, which is attached to an electric generator. Coal is by far the dominant fuel used to generate steam in electric power plants, followed by nuclear power, natural gas, petroleum, and other energy sources. Hydroelectric generators are powered by the release of the tremendous pressure of water existing at the bottom of a dam or near a waterfall. Scientists are also conducting considerable research into renewable sources of electric power—geothermal, wind, and solar energy. Some municipalities capture combustible gasses or burn waste materials at landfills to generate electricity.

Legislative changes have created new classes of firms that generate and sell electricity. Industrial plants often have their own electricity generation facilities, usually capable of producing more than they require. They are called nonutility generators (NUG) and sell their excess power to utilities or to other industrial plants. A type of NUG, termed an independent power producer, is an electricity generating plant designed to take advantage of both industry deregulation and the latest generating technology to compete directly with utilities for industrial and other wholesale customers.

Transmission or high voltage lines supported by huge towers connect generating plants with industrial customers and substations. At substations, the electricity's voltage is reduced and made available for household and small business use via distribution lines, which are usually carried by telephone poles.

Gas production and transmission. Natural gas, a clear odorless gas, is found underground, often near or associated with

crude oil reserves. Exploration and extraction of natural gas is part of the oil and gas extraction industry, covered elsewhere in the *Career Guide*. Once found and brought to the surface, it is transported throughout the United States, Canada, and Mexico by gas transmission companies in pressurized pipelines. Local distribution companies take natural gas from the pipeline, depressurize it, add its odor, and operate the system that delivers the gas from transmission pipelines to industrial, commercial, and residential customers. Nearly half of the natural gas produced is used by industries such as the chemical and paper industries. Households, which use gas for heating and cooking, electric utilities, and commercial businesses—such as hospitals and restaurants—account for most of the rest of the gas consumed.

Combination electric and gas, and other utility services. Utilities are classified as combination utilities when they are involved in both the production of electricity and the distribution of natural gas, or some other utility service. They are considered either electric combined or gas combined services, depending on which service makes up the majority of their business. Combination utilities are usually located in large metropolitan areas.

Water supply. Water utilities provide over 175 gallons of fresh, treated water every day for each person in this country, or about 40 billion gallons per day nationwide. Water is collected from various sources such as rivers, lakes, and wells. After collection, water is filtered, treated, and sold for residential, industrial, commercial, and public use. Depending on the population served by the water system, the utility may be a small plant in a rural area that requires the occasional monitoring of a single operator or a huge system of reservoirs, dams, pipelines, and treatment plants requiring the coordinated efforts of hundreds of people.

Sanitary services. This segment includes sewage systems and refuse systems. Sewage systems collect wastewater from homes and industries, treat it, and return clean water to the surface water supply. Wastewater treatment plants are similar to water treatment plants, but the treatment processes and regulatory requirements are generally more complicated, especially when dealing with industrial wastes.

Refuse systems collect and dispose of household garbage—called municipal solid waste—and refuse from commercial and industrial establishments by processing or destroying it

through the operation of waste treatment plants, landfills, recycling plants, and incinerators. An increasing proportion of refuse is either recycled or burned to generate electricity.

Other utilities include steam and air-conditioning supply utilities, which produce and sell steam and cooled air, and irrigation systems, which operate water supply systems primarily for irrigation.

Utilities and the services they provide are so vital to everyday life that they are considered “public goods” and are heavily regulated. Formerly, utility companies operated as “regulated monopolies,” meaning that in return for having no competition, they were subject to control by public utility commissions that ensured utilities acted in the public interest and regulated the rates they were allowed to charge. However, recent legislative changes have introduced competition into the utilities industry in an effort to promote efficiency, lower costs to customers, and provide users with an increased amount of service options.

Many utility companies are municipally owned. For example, of the roughly 2,000 gas distribution companies in the United States, about 1,000 are municipally owned. In general, utilities serving large cities have sufficient numbers of customers to justify the large expenditures necessary for building plants, and are run by private, investor-owned companies. In rural areas, where the small number of customers in need of services would not provide an adequate return for private investors, the State or local government funds the plant construction and operates the utility.

The various segments of the utilities industry vary in the degree to which their workers are involved in production activities, administration and management, or research and development. Industries such as water supply that employ relatively few workers employ more production workers and plant operators. On the other hand, electric utilities and combination electric and gas utilities generally operate larger plants using very expensive, high technology equipment, and thus employ more professional and technical personnel.

A unique feature of the utilities industry is that urban areas with many inhabitants generally have relatively few utility companies. For instance, there were about 54,000 community water systems in the United States in 1998 serving roughly 253 million people. The 46,000 small water systems served only 25 million people while the 8,000 largest systems served almost 228 million. Alaska, with a population equaling 10 percent of Massachusetts’, had about three times more electric generating plants than Massachusetts in 1998. These examples result from economies of scale in the utilities industry that allow one or two companies to serve large numbers of customers in metropolitan areas more efficiently than many smaller companies.

Unlike most industries, the utilities industry imports and exports only a small portion of its product. In the natural gas industry, this reflects the fact that the country has a sizable, proven resource base that can be used economically to meet the country’s needs. This is the result of a National policy that utilities should be self-sufficient, without dependence on imports for the basic services our country requires. However, easing trade restrictions, increased pipeline capacity, and shipping natural gas in liquefied form have made importing and

exporting natural gas more economical. In 1998, about 14 percent of the natural gas consumed was imported, mostly from Canada. A small portion of natural gas is exported in liquefied form, primarily to Japan.

Working Conditions

Electricity, gas, and water are produced and used continuously throughout each day. As a result, split, weekend, and night shifts are common for utility workers. The average workweek in utilities was 42.2 hours in 1998, compared to 34.6 hours for all industries, and 39.5 hours for all transportation and public utilities. Employees often must work overtime to accommodate peaks in demand and to repair damage caused by storms, cold weather, accidents, and other causes. The industry employs relatively few part-time workers.

The hazards of working with electricity, natural gas, treatment chemicals, and wastes can be substantial, but generally are avoided by following rigorous safety procedures. Protective gear such as rubber gloves with long sleeves, non-sparking maintenance equipment, and body suits with breathing devices designed to filter out any harmful fumes are mandatory for work in dangerous environs. Employees also undergo extensive training on working with hazardous materials and utility company safety measures.

In 1997, the electric services and combination utility services industries reported just 5.7 cases of work-related injury or illness per 100 full-time workers, compared to an average of 7.1 cases for all industries, and 10.3 cases for manufacturing industries. Sanitary services, however, had injury and illness rates higher than the average for all industries, with 11.2 cases per 100 full-time workers, reflecting the physically demanding nature of refuse collection and disposal.

Employment

Public utilities employed about 855,000 workers in 1998. Electric services provided over 40 percent of all jobs, as shown in table 1.

Table 1. Distribution of wage and salary employment in nongovernment public utilities, 1998

(Employment in thousands)

Industry	Employment	Percent
Total, all industries	855	100.0
Electric services	364	42.6
Water supply and sanitary services	196	22.9
Combination utility services	159	18.6
Gas production and distribution	136	15.9

Even though electric utilities are among the biggest customers of natural gas utilities, the processes used to produce their services are largely unrelated. This diversity of production processes is reflected in the size of the establishments that comprise the utilities industry. The combination electric and gas utility industry consists of relatively large plants. In 1997, it accounted for 9 percent of the reporting establishments, yet employed an average of over 100 workers per establishment. On the other hand, water supply utilities accounted for 16 percent of workplaces, yet

employed only an average of 7 workers per establishment (table 2).

Table 2. Nongovernment establishments in electric, gas, and sanitary services and average employment per establishment, 1997

(Employment in thousands)

Industry	Number of establishments	Employment per establishment
Total, all utilities	22,505	37
Sanitary services	6,288	18
Electric services	6,117	57
Gas production and distribution	3,839	33
Water supply	3,723	7
Combination electric and gas, and other combinations	2,125	107
Irrigation systems	316	4
Steam and air-conditioning supply	85	20

SOURCE: U.S. Department of Commerce, *County Business Patterns*, 1997

Although many establishments are small, almost half of public utilities workers are employed in establishments with 250 or more workers (chart).

Occupations in the Industry

About 49 percent of those employed in the public utilities industry work in precision production or operator, fabricator, or laborer occupations (table 3). About 21 percent work in administrative support occupations; another 27 percent are employed in managerial, professional specialty, and technician occupations; and the remaining workers are in marketing, service, and related occupations.

Workers in production occupations install and maintain pipelines and powerlines, operate and fix plant machinery, and monitor treatment processes. *Line installers and repairers* install and repair cables or wires used in electrical power or

distribution systems. They install insulators, wooden poles, and light or heavy-duty transmission towers. *Blue-collar worker supervisors* directly supervise and coordinate the activities of production workers. These supervisors ensure that workers, equipment, and materials are used and maintained properly and efficiently to maximize productivity.

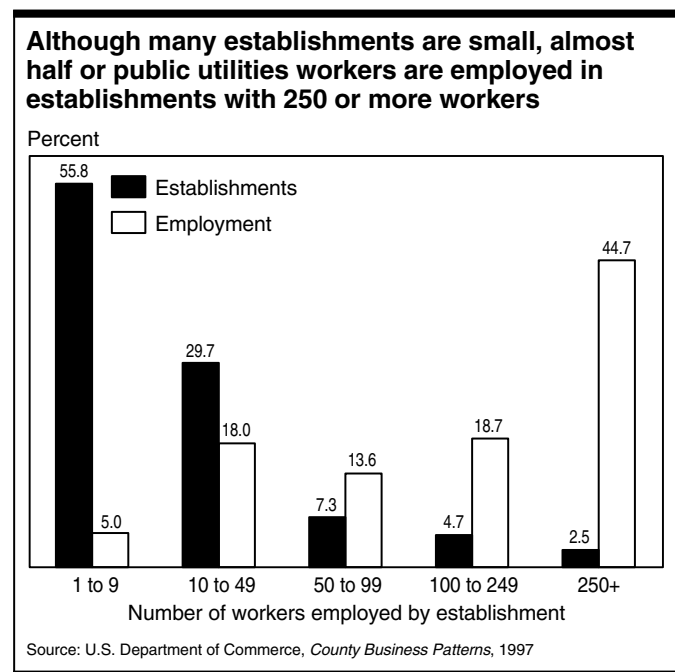
Plant and system occupations include electric power generating plant operators, power reactor operators, power distributors and dispatchers, gas plant operators, and water and wastewater treatment plant operators. *Electric power generating plant operators* control or operate machinery, such as stream-driven turbine generators, to generate electric power, often through the use of control boards or semi-automatic equipment. *Power reactor operators* control nuclear reactors that produce steam for the generation of electric power, coordinate operation of auxiliary equipment, and regularly perform operating tests to ensure all equipment is working properly. *Power distributors* and *dispatchers* coordinate, regulate, or distribute electricity or steam in generating stations, over transmission lines to substations, and over electric power lines. *Gas plant operators* operate gas liquefying-and regasification equipment, operate compressors to control gas pressure in transmission pipelines, and coordinate injections and withdrawals at storage fields. *Water and wastewater treatment plant operators* control the process of treating water or liquid waste, take samples of water for testing, and may perform maintenance of treatment plants.

Industrial machinery repairers install, repair, and maintain machinery in power generating stations, gas plants, and water treatment plants. They repair and maintain the mechanical components of generators, waterwheels, water-inlet controls, and piping in generating stations; steam boilers, condensers, pumps, compressors, and similar equipment in gas manufacturing plants; and equipment used to process and distribute water for public and industrial uses.

Maintenance mechanics, general utility, perform work involving a variety of maintenance skills to keep machines, mechanical equipment, and the structure of an establishment in repair. Generally found in small establishments, duties may involve pipefitting, boilermaking, electrical work, carpentry, welding, and installing new equipment.

Administrative support occupations account for about one-fifth of the jobs in the utilities industry. *Customer service representatives* interview applicants for water, gas, and electric service. They talk with customers by phone or in person and receive orders for installation, turn-on, discontinuance, or change in service. *General office clerks* may do bookkeeping, typing, stenography, office machine operation, and filing. *Meter readers* read electric, gas, water, or steam consumption meters visually or remotely using radio transmitters and record the volume used by residential and industrial customers. Financial records processing occupations, such as *billing, cost, and rate clerks*, compile data, compute fees and charges, and prepare invoices for billing purposes, in addition to the routine calculating, posting, and verifying duties necessary to keep financial records complete.

Operator, fabricator, and laborer occupations include *helpers*, the entry-level occupation in almost all utilities occupations tied to production activities. Other helpers include *refuse collectors*, who collect and dump refuse from containers into a truck. *Material moving equipment operators* distribute refuse around landfills and ensure that the refuse is covered by the



necessary amount of soil or cover each day. *Truckdrivers* operate refuse collection trucks that are either self-loading or loaded by refuse collectors.

Executives, managers, and administrators in the utilities industry plan, organize, direct, and coordinate management activities. They are often responsible for maintaining an adequate supply of electricity, gas, water, steam, or sanitation service.

Professional specialty occupations in this industry include engineers and computer systems analysts, engineers, and scientists. *Engineers* develop technologies that allow, for example, utilities to produce and transmit gas and electricity more efficiently and water more cleanly. They may also develop improved methods of landfill or wastewater treatment operations in order to maintain compliance with government regulations. *Computer systems analysts, engineers, and scientists* develop computer systems to automate utility processes; provide plant simulators for operator training; and improve operator decision making.

Technicians account for only a small proportion of total employment in this industry. Technician occupations include *Engineering and science technicians* who assist engineers in research activities and may conduct some research independently.

Training and Advancement

Public utilities provide career opportunities for persons with varying levels of experience and education. However, because the utilities industry consists of many different companies and products, skills developed in one industry may not be transferable to other industries.

High school graduates qualify for most entry-level production jobs. Production workers may start as laborers or in other unskilled jobs and, by going through an apprenticeship program and gaining on-the-job experience, advance into better paying positions that require greater skills or have greater responsibility. Substantial advancement is possible even within a single occupation. For example, electric power plant operators may move up through several levels of responsibility until they reach the highest paying operator jobs. Advancement in production occupations generally requires mastery of advanced skills on the job, usually with some formal training provided by the employer or through additional vocational training at a 2-year technical college. Additional formal education from an outside source is sometimes needed.

Most computer, engineering, and technician jobs require technical education after high school, although opportunities exist for persons with degrees ranging from an associate degree to a doctorate. These workers are usually familiar with company objectives and production methods which, combined with college education, equips them with many of the tools necessary for advancement to management positions. Graduates of 2-year technical institutes usually fill technician positions. Sometimes graduates of engineering programs will start as technicians until an opportunity to advance into an engineering position arises.

Managerial jobs generally require a 4-year college degree, though a 2-year technical degree may be sufficient in smaller plants. Managers can usually advance into higher-level management jobs without additional formal training outside the

workplace. Competition is expected to be keen for management positions, as recent industry restructuring is forcing utility companies to shed excess layers of management to improve productivity and be able to compete in the new de-regulated environment.

Table 3. Employment of wage and salary workers in public utilities by occupation, 1998 and projected change, 1998-2008

(Employment in thousands)

Occupation	1998		1998-2008 Percent change
	Employment Number	Percent	
All occupations	855	100.0	-3.8
Precision production, craft, and repair	312	36.6	-4.9
Electric powerline installers and repairers	61	7.2	-14.6
Blue collar worker supervisors	46	5.4	-6.0
Electric power generating plant operators, distributors, and dispatchers	31	3.7	-2.5
Industrial machinery mechanics	25	3.0	-5.4
Maintenance repairers, general utility	16	1.9	-6.7
Vehicle and mobile equipment mechanics and repairers	14	1.6	8.3
Water and liquid waste treatment plant and system operators	9	1.1	44.3
Construction equipment operators ...	8	0.9	13.9
Administrative support, including clerical	179	20.9	-9.8
Meter readers, utilities	27	3.1	-11.3
General office clerks	22	2.6	1.0
Financial records processing occupations	20	2.3	-5.3
Office and administrative support supervisors and managers	17	2.0	-4.0
Secretaries	15	1.8	-22.1
Stock clerks and order fillers	8	1.0	-8.9
Adjusters, investigators, and collectors	8	0.9	-5
Operators, fabricators, and laborers ...	105	12.3	13.8
Helpers, laborers, and material movers, hand	50	5.8	2.7
Truckdrivers	32	3.7	36.0
Material moving equipment operators	12	1.4	10.2
Executive, managerial, and administrative	114	13.3	-5.5
General managers and top executives	17	2.1	7.5
Communication, transportation, and utilities operations managers	16	1.9	-6.1
Accountants and auditors	10	1.2	-11.9
Engineering, natural science, and computer and information systems managers	7	0.9	15.3
Professional specialty	71	8.3	-2.1
Electrical and electronics engineers ..	13	1.5	-9.4
Computer systems analysts, engineers, and scientists	11	1.3	22.2
Technicians and related support	43	5.0	-15.7
Engineering technicians	21	2.5	-11.4
Drafters	9	1.1	-27.7
Marketing and sales	17	1.9	3.5
All other occupations	14	1.7	-4

Earnings

Overall, the industry had average weekly wages of \$843 in 1998. Earnings varied by industry segment within public utilities (table 4). Average weekly earnings for production workers were highest in combination utilities (\$1,024) and electric services (\$878), and lowest in sanitary services (\$674).

Table 4. Average earnings and hours of nonsupervisory workers in public utilities by segment of industry, 1998

Industry segment	Earnings		Weekly hours
	Weekly	Hourly	
Total, private industry	\$442	\$12.77	34.6
Public utilities	843	19.97	42.2
Combination utility services	1,024	24.30	42.9
Electric services	878	21.01	41.8
Gas production and distribution	783	18.56	42.2
Sanitary services	674	15.70	42.9

Earnings in public utilities are generally higher than earnings in other industries. The hourly earnings for production workers in public utilities averaged \$19.97 in 1998, compared to \$15.34 in all transportation, communications, and public utilities, and \$12.77 in all private industry. This was due in part to more overtime and weekend work—as utility plant operations must be monitored 24 hours a day—which commands higher hourly rates. Earnings in selected occupations in public utilities appear in table 5.

Table 5. Median hourly earnings of the largest occupations in public utilities, 1997

Occupation	Public utilities	All industries
General managers and top executives ...	\$34.30	\$26.05
First-line supervisors and manager/ supervisors-mechanics, installers, and repairers	24.34	18.17
Electrical Power-Line Installers and Repairers	20.75	19.87
Maintenance mechanics, water or power generation plant	20.26	17.64
First-line supervisors and managers/ supervisors-clerical and administrative support workers	18.60	14.26
Meter readers, utilities	14.10	12.15
Customer service representatives, utilities	13.79	12.55
Truck drivers, heavy or tractor-trailer	13.37	13.08
General office clerks	11.22	9.10
Refuse and recyclable material collector	11.00	10.19

Almost 34 percent of workers in public utilities are union members or are covered by a union contract, more than double the 15.4 percent rate for all industries.

Outlook

Employment in public utilities is expected to decline by 4 percent from 1998 to 2008. Projected employment change, however, varies by industry segment, as shown in table 6. Although electric power and natural gas are essential to everyday life, employment declines will result from improved

production methods and technology, energy conservation by consumers and more efficient appliances, and a more competitive regulatory environment.

Table 6. Projected employment growth in public utilities by industry segment, 1998-2008

Industry segment	Percent change
Total, all public utilities	-3.8
Water supply and sanitary services	34.3
Electric services	-14.5
Combination utility services	-17.2
Gas production and distribution	-14.4

Over the past several years, deregulation of electric and gas utilities has increased competition and provided incentives for improved efficiency. For example, non-utility generators of electricity, such as a major industrial plant operating its own power generators, now are allowed to sell their excess electricity to utilities at competitive rates. Independent power producers can now build electric power generating plants for the sole purpose of selling their power to utilities. These producers generally build gas-turbine-generating plants, which have lower construction and environmental costs, fewer employees, and can generally sell electric power more cheaply than the coal-powered steam-turbine generator plants.

In the gas transmission and distribution industry, regulatory changes now allow wholesale buyers to purchase gas at competitive rates from any producer and to use the gas pipeline transmission network to transport the gas. This process is also occurring at the distribution level. These changes caused an increase in gas and electric utility mergers, workforce reductions, and the redesign and reallocation of job duties in a process that will continue through the projection period.

New energy policies also provide for investment tax credits for research and development directed at renewable sources of energy and set standards for the efficiency of the various types of equipment used in electric utilities. As a result, electric utilities will continue to improve the productivity of their plants and workers, resulting in a slowdown in employment opportunities. However, highly trained technical personnel with the education and experience to take advantage of new developments in electric utilities should face good prospects for employment.

In the water supply and sanitary services industries, regulatory changes have had the opposite impact. Regulations in these industries have not been designed to increase competition, but to increase the number of contaminants that must be monitored and treated and to tighten the environmental impact standards of these industries, resulting in increased employment.

Two non-regulatory competing trends affect gas production and distribution utilities. Although natural gas is an increasingly popular choice among homeowners and businesses, the efficiency of natural gas furnaces has increased dramatically, significantly reducing average home consumption. These energy-conserving technologies are expected to decrease the relative use of natural gas by most industries and by individual homes. In addition, utilities in colder climates have begun to automate meter reading and billing procedures. Combined, these developments are projected to

result in a decrease in employment in natural gas transmission and distribution services.

Water supply and sanitation services are projected to be the fastest growing sector of public utilities, with employment projected to increase 34 percent from 1998 to 2008. This industry is expected to grow due to an increase in the amount of waste generated per person, an increase in population, increasing disposal requirements for different materials, and an increase in the percentage of refuse that is recycled. Also, newly constructed housing developments are more likely to have community water supplies and wastewater treatment facilities, increasing demand for these services. About 14,000 new jobs in this industry will be created for truckdrivers and operators of material moving equipment, such as landfill bulldozer operators. Despite automation and other improvements in production technology in this industry, expanding hazardous waste regulations and the increase in recycling facilities are expected to contribute to growth in production workers such as hazardous materials removal workers, water and liquid waste treatment plant operators and machinery, equipment, and motor vehicle mechanics.

In general, persons with college training in advanced technology will have the best opportunities in public utilities industries. Computer engineers, scientists, and systems analysts are expected to be among the fastest growing occupations in the professional specialty occupational group. With emphasis on improving plant automation and productivity, employment of these college-educated workers is projected to grow by 22 percent. Marketing and sales workers are expected to increase in number and importance as competition for wholesale customers, who can now buy power from the lowest bidder, increases and utilities begin to rely on their sales staff to expand their customer base. Some administrative support workers, such as meter readers and financial records processing occupations, are among those affected by increasing automation. Technologies

including radio-transmitting meter reading and computerized billing procedures are expected to decrease employment.

Sources of Additional Information

General information on the public utilities industry and employment opportunities is often available from local utilities, the unions to which their workers belong, and from:

- American Gas Association, 400 N. Capitol St. NW., Washington, DC 20001.
Internet: <http://www.aga.org>
- Utility Workers Union of America, 815 16th St. NW., Suite 605, Washington, DC 20006.
- American Water Works Association, 6666 West Quincy, Denver, CO 80235.
- International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, DC 20005.

Detailed information on many of the key occupations in the public utilities industry, including the following, may be found in the 2000-01 edition of the *Occupational Outlook Handbook*:

- Blue-collar worker supervisors
- Computer engineers and scientists
- Computer systems analysts
- Electrical and electronics engineers
- Electric power generating plant operators and power distributors and dispatchers
- Engineering technicians
- Handlers, equipment cleaners, helpers, and laborers
- Industrial machinery repairers
- Line installers and repairers
- Maintenance mechanics, general utility
- Material moving equipment operators
- Nuclear engineers
- Water and wastewater treatment plant operators